Want to become an Army astronaut? Here' how...

(The following was submitted by Army Astronaut Col. Bill McArthur. There are seven Army astronauts assigned to the Army Space Command, with duty at the Johnson Space Center, Houston, Texas.)

A total of 12 Astronauts have been selected from the Army, including two who were selected during the last board in 1998. Hopefully, the guidelines presented below will assist interested Army personnel in preparing their applications for this highly competitive position. The goal is to increase the participation of soldiers in the human exploration of space. All applications submitted to the 1998 Army Astronaut Candidate Screening Board were reviewed by Mr. Rick Yager, Army Acquisition Corps Assignments, and several current Army Astronauts. The board members felt it would be beneficial to provide guidance to assist Army personnel in strengthening their applications for this highly competitive process. Since the original seven astronauts were selected in 1959, NASA has selected 16 additional Astronaut Candidate classes with a selection rate of less than one percent for the Astronaut Candidate program. The following suggestions have been reviewed by the Army's most senior astronauts and by Mr. Duane Ross, Chief of the Astronaut Selection Office at Johnson Space Center, Houston, Texas.

Team players wanted…NASA seeks candidates who have demonstrated the ability to work as team members in a highly stressful environment. For this reason, the NASA astronaut application should emphasize these qualities. Highlight your abilities to function in a stressful work environment and to operate as a team player.

Details…details…One of the factors that the Astronaut Selection Board uses to judge the seriousness of potential candidates is the care that is taken to prepare the application itself. Attention to detail is as important for astronauts as it is for professional soldiers. The care that candidates take with their application is a direct indicator of their potential performance in this detail- oriented job. Anything less than perfect is *not good enough*. An application that is deemed to be unprofessional in quality or is incomplete is an indication to the Board the candidate might not consider him / herself to be a serious competitor. Examples cited during the most recent Army Astronaut Candidate Screening Board include:

1. Applications missing one or more required forms. The most frequently noted form missing was the List of Previous Supervisors.
2. JSC Form 498 states "see attached OERs/ ORBs" instead of providing descriptions of previous positions and experience. Take the time to summarize your work experience in terms that NASA personnel will under-stand and that will help you look like a strong candidate.

Applicants who apply for both the Astronaut-Mission Specialist and Astronaut-Pilot positions…The minimum requirements for Astronaut-Pilot positions are 1000 hours in high performance jet aircraft, with test pilot experience in high performance aircraft highly desirable. If you clearly do not meet these requirements and still apply for that position, you lose credibility.

Write in third person…Refrain from using "I" frequently in job and experience descriptions, since this may imply an abrasive ego.

All-around American… Include outside interests, hobbies and athletic activities in your application. Some common threads can be identified from astronaut biographies - active people with a variety of interests like running, scuba diving, flying, group sports, climbing, etc.

Don't be modest… Special awards and recognitions are used by board members to filter out those who de-serve a closer look. Be sure anything that separates you from your peers is easily seen in your application, i.e., distinguished or honor graduate of a military course and special military or community awards.

Type those forms…Applications should be type-written. Use the computer-based forms available from NASA on the Internet if possible http://www.jsc.nasa.gov/ah/jscjobs/aso/astroapp.htm

Speak English… not *militaryese*... Keep in mind that a significant number of the individuals at NASA reviewing your application are civilians; many with no prior military experience. The following tips are provided based on experience reviewing records and applications:

1. Provide clear, concise descriptions of your military experience. Avoid military acronyms and try to state jobs in "civilian equivalent terms".
2. Emphasize the operational aspects of your military experience rather than the management aspects.
3. Stress any related experience in your qualifying degree field including research during the completion of advanced degrees.
4. Refrain from writing your application in a manner similar to Officer Efficiency Reports, or OERs. It is not as important to stress the number of troops you have commanded or the monetary value of the equipment under your control as it is to stress your operational experience.
5. The day-to-day responsibilities of an astronaut position are "hands-on", operationally oriented. NASA looks for candidates who desire this type of position, rather than management or command.

Flight experience… Although not a requirement for the Mission Specialist position, flight experience is highly desirable. Applicants who are not military aviators should stress any civilian aviation experience.

Don't do it… Congressional letters of endorsement are inappropriate for the Astronaut Selection Board. If you do choose to include these, please review them before submission. A letter of recommendation that begins "although I have never personally met the candidate" has little impact.

Do it… Advanced civilian education is important. Higher degrees and recently accomplished education in technical fields is valuable. Very few applicants are selected without an advanced degree, i.e., Master's or Ph.D.

Now what?

Once all applications are received by NASA—to include those nominated by respective military services and all civilian applicants—a screening board rates applicants according to the following parameters:

— demonstrated performance
— experience in stressful environments
— responsibility of assignments
— breadth and quality of experience, and
— relatedness of education and training

Individuals will be also be assigned to one of the following discipline groups for further consideration:

— space science
— earth science
— life science
— materials science
— general engineering, and
— flight test engineering

Applicants have no input concerning which discipline group they are placed into. This decision is made by the screening board, based upon the educational and occupational experience information provided by the individual on the application. The screening process ultimately reduces the extremely large number of applicants—typically 3,000— to approximately 100 highly qualified individuals. These finalists will be invited to the Johnson Space Center for comprehensive medical evaluations and an individual one-hour interview with the Astronaut Selection Board. Applicants may have little insight into their status during the selection process. Information is readily available from the Army Personnel Command on whether an application has been sent to NASA. From that point on, however, applicants have little or no contact from NASA unless selected for an interview. In this case, no news is *not* good news!

Selection and training of astronauts

The astronaut candidate program is an ongoing program. NASA accepts applications from qualified individuals -- from both civilian and military walks of life -- on a continuing basis, selecting candidates as needed for the rigorous, 1-year training program directed by JSC (Johnson Space Center - Houston). Upon completing the course, successful candidates become regular members of the astronaut corps. Usually they are eligible for a flight assignment about 1 year after completing the basic training program.

Pilot Astronauts

Early in the U.S. manned space program, jet aircraft and engineering training were prerequisites for selection as an astronaut. Today, scientific education and experience are equally important prerequisites in selecting both pilots and mission specialists. Pilot astronauts play a key role in Shuttle flights, serving as either commanders or pilots. During flights, commanders are responsible for the vehicle, the crew, mission success and safety -- duties analogous to those of the captain of a ship. Shuttle commanders are assisted by pilot astronauts who are second in command and whose primary responsibilities involve controlling and operating the Shuttle. During flights, commanders and pilots usually assist in spacecraft deployment and retrieval operations using the RMS arm or other payload-unique equipment on board the Shuttle.

To be selected as a pilot astronaut candidate an applicant must meet a number of basic qualification requirements. A bachelor's degree in engineering, biological science, physical science or mathematics is required. A graduate degree is desired, although not essential. The applicant must have had at least l,000 hours flying time in jet aircraft. Experience as a test pilot is desirable, but not required. All applicants -- pilots and missions specialists -- must be citizens of the United States.

Physically, an applicant must pass a strict physical examination and have a distant visual acuity no greater than 20/50 uncorrected, correctable to 20/20. Blood pressure, while sitting, must be no greater than 140 over 90. An applicant also must also be from 64" to 76" tall.

Mission Specialist Astronauts

Mission specialist astronauts, working closely with the commander and pilot, are responsible for coordinating on board operations involving crew activity planning, use and monitoring of the Shuttle's consumables (fuel, water, food, etc.), and conducting experiment and payload activities. They are required to have a detailed knowledge of Shuttle systems and the "operational characteristics, mission requirements and objectives and supporting systems for each of the experiments to be conducted on the assigned missions." Mission specialists perform on-board experiments, spacewalks (called extravehicular activity (EVA) and payload handling functions involving the RMS arm. The basic physical qualifications for selection as a mission specialist astronaut are the same as those for pilots, except that uncorrected visual acuity can be as high as 20/100, correctable to 20/20. A candidate's height can range from 60" to 76".

Academically, applicants must have a bachelor's degree in engineering, biological science, physical science or mathematics plus at least 3 years of related and progressively responsible professional experience. An advanced degree can be substituted for part or all of the experience requirement, 1 year for a master's degree and 3 years for a doctoral degree.

Payload Specialists

This newest category of Shuttle crew member, the payload specialist, is a professional in the physical or life sciences or a technician skilled in operating Shuttle-unique equipment. Selection of a payload specialist for a particular mission is made by the payload sponsor or customer. For NASA-sponsored spacecraft or experiments requiring a payload specialist, the specialist is nominated by an investigator working group and approved by NASA.

Payload specialists for major non-NASA payloads or experiments are selected by the sponsoring organization. payload specialists do not have to be U.S. citizens. However, they must meet strict NASA health and physical fitness standards.

In addition to intensive training for a specific mission assignment at a company plant, a university or government agency, the payload specialist also must take a comprehensive flight training course to become familiar with Shuttle systems, payload support equipment, crew operations, housekeeping techniques and emergency procedures. This training is conducted at JSC and other locations, as required. Payload specialist training may begin as much as 2 years before a flight. Since the STS 51-L accident, the payload specialist program has been under review by NASA and a decision is pending on whether to continue with this special crew member category.

Astronaut Training

Astronaut training is highly specialized and requires the efforts of literally hundreds of persons and numerous facilities. It is conducted under the auspices of JSC's Mission Operations Directorate. As manned space flight programs have become more sophisticated over the years so too has the complex and length training process needed to meet the demands of operating the Space Shuttle. Initial training for new candidates consists of a series of short courses in aircraft safety, including instruction in ejection, parachute and survival to prepare them in the event their aircraft is disabled and they have to eject or make an emergency landing. Pilot and mission specialist astronauts are trained to fly T-38 high-performance jet aircraft, which are based at Ellington Field near JSC.

Flying these aircraft, pilot astronauts are able to maintain their flying skills and mission specialists are able to become familiar with high-performance jets.

In the formal academic areas, the novice astronauts are given a full range of basic science and technical courses, including mathematics, Earth resources, meteorology, guidance and navigation, astronomy, physics and computer sciences. Basic knowledge of the Shuttle system, including payloads, is obtained through lectures, briefings, text books and flight operations manuals. Mockups of the orbiter flight and middecks, as well as the mid-body, including a full-scale payload bay, train future crew members in orbiter habitability, routine housekeeping and maintenance, waste management and stowage, television operations and extravehicular activities.

Astronauts use conventional and modified aircraft to simulate actual landings. In addition to the T-38 trainers, the four-engine KC-135 provides experience in handling large, heavy aircraft. Pilot astronauts also use a modified Grumman Gulfstream II, known as the Shuttle Training Aircraft (STA), which is configured to simulate the handling characteristics of the orbiter. It is used extensively for landing practice, particularly at the Ames-Dryden Flight Research Facility (DFRF) in California and at KSC's Shuttle Landing Facility.

As training progresses, the student astronauts gain one-on-one experience in the single systems trainers (SST) located in Building 4 at JSC. The SSTs contain computer data bases with software allowing students to interact with controls and displays like those of a Shuttle crew station. Here

they can develop work procedures and react to malfunction situations in a Shuttle-like environment.

Learning to function in a weightless or environment is simulated in aircraft and in an enormous "neutral buoyancy" water tank at JSC. Aircraft weightless training is conducted in a modified KC- 135 four-engine jet transport. Flying a parabolic course, the aircraft is able to create up to 30 seconds of weightlessness when flying a parabolic maneuver.

During this rather brief period of time, astronauts can practice eating and drinking as well as use various kinds of Shuttle-type equipment. Training sessions in the KC-135 normally last from 1 to 2 hours, providing an exciting prelude to the sustained weightless experience of space flight. Longer periods of weightlessness are possible in the neutral buoyancy tank, officially called the Weightless Environment Training Facility (WETF), in Building 29 at JSC. Here, a full-scale mockup of the orbiter payload bay and airlock can be placed in the 25-foot-deep water tank permitting extended training periods for practicing EVA -- space walks -- by trainees wearing pressurized EVA suits.

The facility also is an essential tool for the design, testing and development of spacecraft and EVA crew equipment. In addition, it makes possible evaluation of payload bay body restraints and handholds, permits development of various crew procedures and, perhaps most importantly, helps determine an astronaut's EVA capabilities and workload limitations.

Other major operations training facilities at JSC include the Computer-Aided Instructional Trainer (CAIT) in Building 4, which fills the gap between textbook lessons and more complex trainers and simulators; the Crew Software Trainer (CST) used to demonstrate orbiter software capabilities before students go on to the SSTs; the Shuttle Mission Simulator (SMS) described earlier; the Orbiter Crew Compartment Trainer in Building 9A, used to train crew members for most of their on-orbit duties.

Most of these training facilities also are used by regular members of the astronaut corps to help them maintain proficiency in their areas of specialization. Since the orbiter lands on a runway much like a high-performance aircraft, pilot astronauts use conventional and modified aircraft to simulate actual landings. In addition to the T-38 trainers, the four-engine KC-135 provides experience in handling large, heavy aircraft. Pilot astronauts also use a modified Grumman Gulfstream II, known as the Shuttle Training Aircraft (STA), which is configured to simulate the handling characteristics of the orbiter. It is used extensively for landing practice, particularly at the Ames-Dryden Flight Research Facility (DFRF) in California and at KSC's Shuttle Landing Facility.

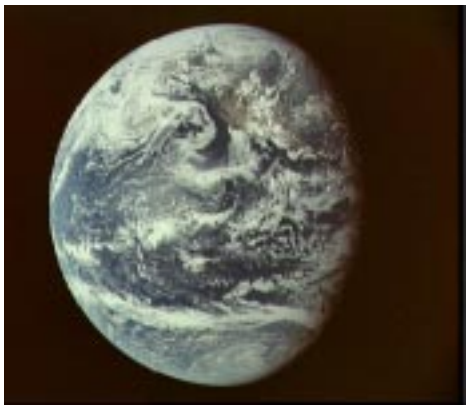
Advanced Training

Advanced training follows the 1-year basic training course for new astronauts. The Mission Operations Directorate's Flight and Systems Branches at JSC direct this advanced training which includes 16 different course curricula covering all Shuttle-related crew training requirements. The courses range from guidance, navigation and control systems to payload deployment and retrieval systems. This advanced training encompasses two specific types of instruction. These are system-related and phase-related training.

The bulk of system-related training is carried out in the various low and medium fidelity trainers and computer-aided instructional trainers at JSC. This approach permits self-paced, interactive programmed instruction for both initial and refresher systems training. Systems instructors provide one-on-one training by controlling simulator software, setting up staged malfunctions and letting the trainee solve them. System training is designed to provide instruction in orbiter systems. It is not related to a specific mission or its cargo. It is designed to familiarize the trainee with a feel for what it's like to work and live in space. Generally, systems training is completed before an astronaut is assigned to a mission.

As its name implies, the second type of advanced training, phase-related training, concentrates on the specific skills an astronaut needs to perform successfully in space. This training is conducted in the SMS, which is the primary facility for training astronauts in all phases of a mission from liftoff to landing. Phase-related training continues after a crew is assigned to a specific mission, normally about 7 months to 1 year before the scheduled launch date.

From this point on, crew training becomes more structured and is directed by a training management team. At any one time, there are nine structured Shuttle Mission Simulator teams operating at JSC. Each is assigned to a specific Shuttle flight. These specialized teams are responsible for directing the remaining advanced training needed for a specific flight. This includes what is described as "stand-alone training and flight-specific integrated and joint integrated training." It involves carefully developed scripts and scenarios for the mission. This intensive training is designed to permit the crew to operate as a closely integrated team, performing normal flight operations according to a flight timeline.



At about 10 weeks before a scheduled launch, the crew begins what are called "flight-specific integrated simulations, designed to provide a dynamic testing ground for mission rules and flight procedures." Just as during a real mission, the crew works at designated stations interacting with the flight control team who man their positions in the operationally-configured MCC. These final pre-launch segments of training are called integrated and joint integrated simulations and normally include the payload users' operations control centers. Everything from EVA operations to interaction with the tracking networks can be simulated during these training sessions.

The integrated simulations are directed by a simulation supervisor, who is referred to as the "sim sup," assisted by a team of flight-specific instructors who direct and observe the simulations, evaluate crew and controller responses to malfunctions and other flight-unique situations. This final intensive training joint crew/flight controller effort is carried out in parallel with the complex and extensive activity called mission planning.

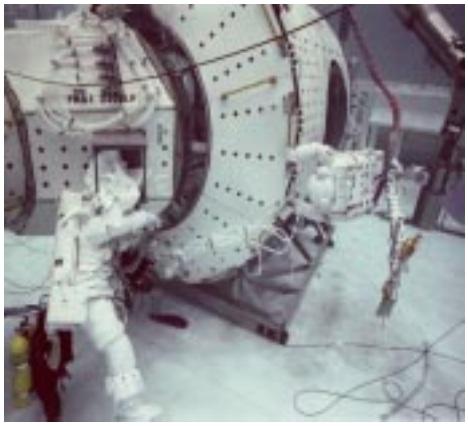
Shuttle Mission Simulator

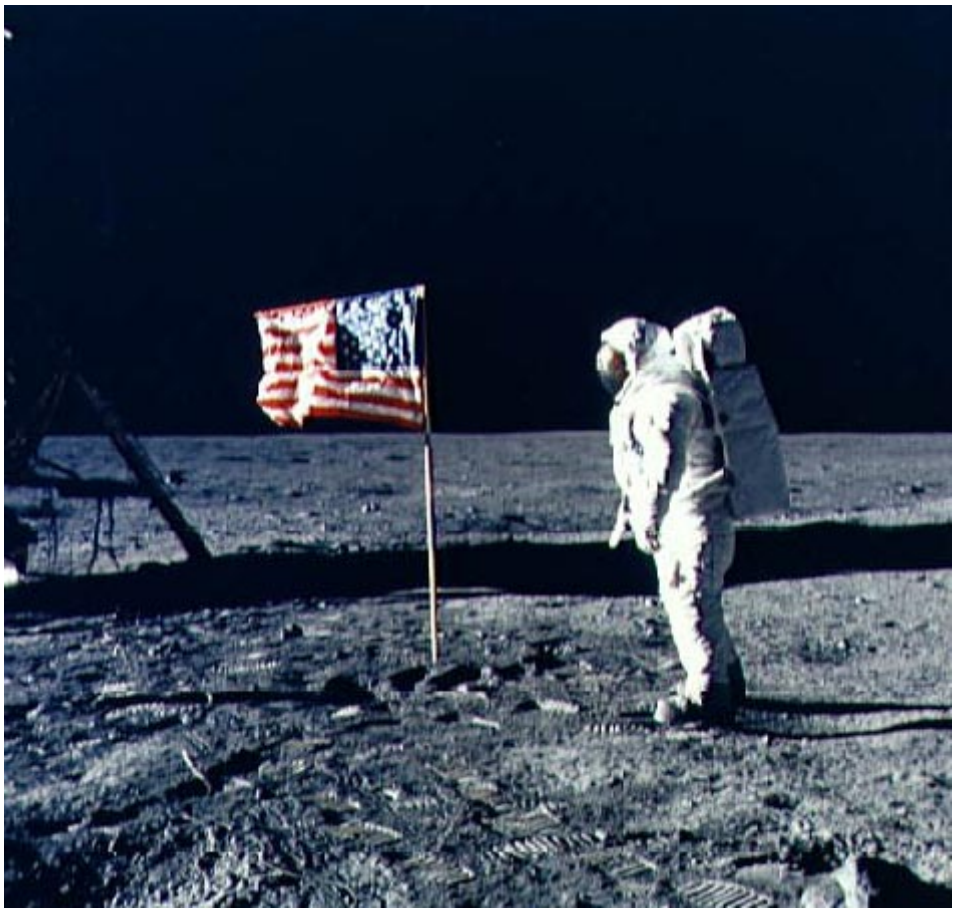
The Shuttle Mission Simulator (SMS) is the primary system for training Space Shuttle crews. Located in Building 5 at JSC, it is described as the only high-fidelity simulator capable of training crews for all phases of a mission beginning at T-minus 30 minutes, including such simulated events as launch, ascent, abort, orbit, rendezvous, docking, payload handling, undocking, deorbit, entry, approach, landing and rollout.

The unique simulator system can duplicate main engine and solid rocket booster perfor-

mance, external tank and support equipment and interface with the MCC. The SMS construction was completed in 1977 at a cost of about $100 million. The SMS is operated for NASA by the Link Flight Simulation Division of The Singer Co., Binghamton, N.Y.

Major components of the SMS are two orbiter cockpits, one called the motion-base crew station (MBCS) and the other the fixed-base crew station (FBCS). Each is equipped with the identical controls, displays and consoles, of an actual orbiter. Although in many ways more complex, the crew station simulators are similar to the trainers used for commercial airline pilots.





The MBCS is configured for Shuttle commander and pilot positions. It operates with motion cues supplied by a modified 6-degree-of-freedom motion system providing motion simulation for all phases of a flight from launch to descent and landing. A special tilt frame provides a 90-degree upward tilt that simulates acceleration of liftoff and ascent.The FBCS is configured for the commander, pilot, mission specialist and payload operations crew positions. While it does not simulate motion, it does have navigation, rendezvous, remote manipulator and payload accommodation systems configured to simulate specific payload activities planned for future missions. The FBCS is located on an elevated platform and it is entered through a hatch like the one on the orbiter. During long-duration mission simulations water and food are provided in the FBCS.

Visual simulations for the two training stations are provided by four independent digital image generation (DIG) systems. The DIG can display scenes for every phase of a Shuttle mission from pre-launch pad views to landing and rollout on the runway. The views are displayed in color in the six orbiter forward windows of the two stations, while the overhead and two aft widows have a green hue. The Earth, sun, moon and stars are included in these visual scenes. A closed circuit television display provides proper spatial ordering of moving objects for aft window and closed circuit TV fields of view. The closed circuit TV also permits viewing the payload through fixed cameras or through cameras mounted on remote manipulator arms. This is important for payload deployment and retrieval training.

Computer-generated sound simulations come from hidden loudspeakers which duplicate those experienced during an actual flight, including the onboard pumps, blowers, mechanical valves, aerodynamic vibrations, thruster firings, pyrotechnic explosions, gear deployment and runway touchdown.

SMS instructors at consoles act as devil's advocates in devising scenarios of systems failures or other circumstances to which astronaut crews and flight control teams must react. There are about 6,800 malfunction simulations that can be activated from the instructor consoles. Both SMS trainers can be used separately or in integrated simulations linked to flight control teams in the MCC. Two independent computer facilities comprise the SMS computer system.